

Annex I

STATUS OF US PROJECTS RELATED TO THORIUM UTILIZATION

Two major thorium-fuelled reactor programmes have been actualized in the US. These are the Molten Salt Breeder Reactor and the Light Water Breeder Reactor. A third, the High Temperature Gas Reactor, was envisioned to utilize thorium, but this had not been accomplished. Instead this reactor utilized enriched uranium.

The study and development of molten-salt reactors was begun in the US at the Oak Ridge National Laboratory in 1947. The potential of MSBR for civilian power production was recognized and a development programme was established in 1956. A Molten Salt Reactor Experiment was operated from 1969. It was fuelled with a U^{235} - U^{238} mixture during the initial two years of operation and with U^{233} during the remaining 1.5 years of operation. The successful operation of MSRE and the favorable projected system characteristics attracted significant US industrial and utility interest. The development of molten-salt reactors was interrupted in 1973 when the programme was terminated. The programme was resumed briefly in 1974 but finally terminated in mid 1976.

The second major reactor concept utilizing thorium was the Light Water Breeder Reactor. The concept, then called seed-blanket, was originally introduced in 1951 as a means of minimizing the separative work required for the fuel of a light water reactor. The seed-blanket concept was employed in the design of the first commercial PWR plant at Shippingport, Penn.

It was long thought to be impractical to breed with light water; however, since the value of η for U^{233} is only slightly lower in the epithermal region, while that of U^{235} and Pu^{239} are greatly reduced, the thorium cycle appeared to be most attractive for a thermal breeder. After preliminary work in the early 1960s indicated the feasibility of breeding in a light water seed-blanket core on the thorium cycle, the US AEC authorized a demonstration in the Shippingport Plant. This is the Light Water Breeder Reactor Project. Full-power operation of the demonstration began in December 1977.

The reactor has operated on thorium and U^{233} cycles until 1982 at which time it was shut down. It is understood that the spent fuel is presently being reprocessed to provide an accurate check against physics calculations. Many reports on the project should be forthcoming.